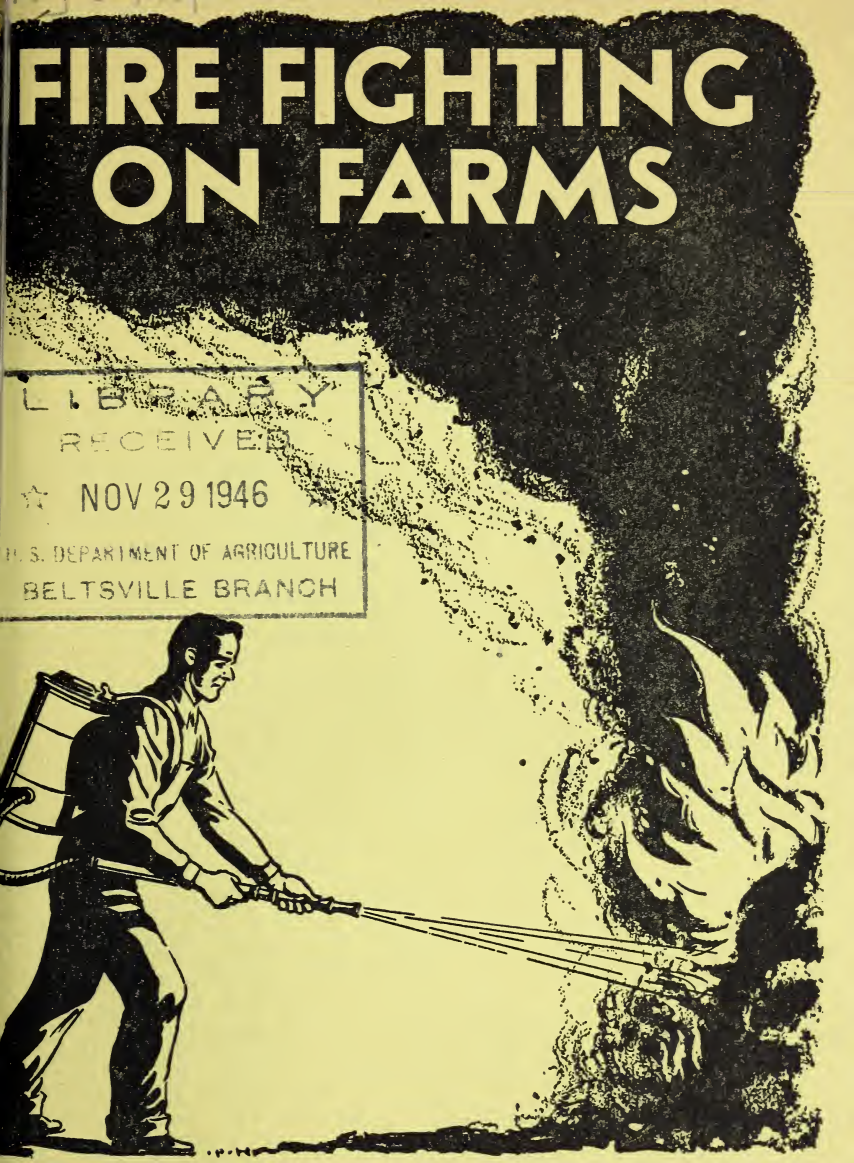
FIRE FIGHTING ON FARMS



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Fire Fighting on Farms

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MANY rural communities are too remote from town and city fire departments to summon help in time of need. As in all other emergencies, these communities must be resourceful. They must know what to do and how to do it in time. The best preparation for fighting farm fires effectively is to train cooperative groups for each neighborhood. In such cooperation all the men, the women, and the youth can play a definite part for the welfare of their own and of neighboring communities.

WHY TRAIN FARM FIREMEN?

Saving lives and property from fire requires trained manpower.

Farm firemen need to know (1) how to get people out of a burning building safely, (2) how to rescue the injured and helpless, and (3) how to save property.

The training starts at home, where every farm family should know how to act quickly in case of fire. Farm people must be alert to the danger of fire and they must know how to get help and fight fire promptly.

The *first 5 minutes* are most important. Five minutes or less may be all the time you have to rescue the family—to send out the fire alarm—to fight the fire before it gets beyond control. A simple fire-fighting plan is needed on every farm, and every member of the family should understand its essentials. These are:

1. Quickly removing all persons to safety.

2. Prompt signaling for help.
3. Skillfully fighting a small fire before it spreads.
4. Protecting other buildings, livestock, and property.
5. Fighting the fire with neighborhood cooperation.

Skill Is Needed

Skill is as necessary in fighting fire as in any other difficult and dangerous work. Fires are treacherous. They often defy the best efforts and skill of firemen. This is especially true in fighting violent fires and those in hidden places.

Farm firemen need training so they can work together quickly and skillfully in all phases of fire fighting. In addition to fighting fire, the firemen must know how to protect themselves and others, and they should know how to reduce all kinds of fire hazards.

Who Are Farm Firemen?

Farm firemen are farm people who are trained to help themselves and their neighbors in fighting fires. They include farmers, farm laborers, farm women, and the older boys and girls. They work together in the farm homes and in their neighborhoods to prevent and fight fire.

Farm firemen may organize as a company, association, or society, or they may just work together in a neighborly way without special organization. All that is necessary is that they be interested in fighting fires and trained to fight them.

Purpose of This Manual

The purpose of this manual[1] is to suggest ways for farm

[1] The information presented was taken from many publications and other sources. The recommendations are largely adaptations of standard fire-fighting practices to farm needs and conditions. In addition to many persons in several bureaus of the Department of Agriculture, fire marshals, and representatives of State colleges of agriculture, extension services, departments of conservation, and the National Fire Protection Association were helpful in many ways—in suggesting the subjects to be covered, the illustrations to be included, and the method of presentation

people in any neighborhood to use their knowledge, skill, manpower, and fire-fighting equipment effectively. The suggestions point to the needs in neighborhoods of 6 to 20 farm families. Large neighborhoods may have 20 to 30 firemen, while the small ones may have only 8 to 12.

In some instances two or more neighborhoods may be concerned in fighting fires on adjoining areas. This calls for cooperation between neighborhoods. The need for cooperation should be anticipated and provided for in any plan of community organization and training.

PHASES OF TRAINING

Three phases of fire fighting are needed. They are guard work, fire extinguishing, and salvaging.

Guard work is necessary to keep people from getting hurt. Its purpose is to control the movements and actions of people who are not actually fighting the fire. It includes keeping roads, drives, and walks open for firemen and protecting property from damage.

Fire extinguishing is the actual work of fighting the fire, including the use of equipment. Rescue work and first aid are essential parts of fire fighting and should be included in every fireman's training.

Salvaging is considered the supporting part of fire fighting. It includes removal of livestock, protection of property, guarding the structure after the fire, mop-up work, temporary repair of structures, and returning the fire-fighting equipment.

Guard Work

Fire draws crowds. In the excitement, guards are needed to prevent spectators from hindering the work of firemen. Guard duty extends to preventing damage to fences, lawns, shrubs, gardens, and fields. It gives special attention to the direction of the wind, to traffic on narrow country roads and lanes leading to the fire, and to keeping trafficways open for the fire apparatus and firemen.

Each farmstead presents a distinct problem in the protection of persons, livestock, and property. To do guard work properly it is necessary to know the location of roads, lanes, fences, drives, walks, gates, water supplies, and pumping equipment.

Each farm fireman (or farmer) should make a sketch of his farmstead, showing these features. For a typical farmstead plan, see figure 1. Those responsible for guard work should study the sketches and outline a plan for directing traffic and for controlling crowds on each farmstead. It would be advantageous to go from farm to farm to see the actual farmsteads. The best sketch and plan of each farmstead should be kept as guides to indicate what must be done in case of fire.

In planning guard work for the protection of people and property the following needs should be considered for each farm:

1. Providing a safe refuge for members of the family and others who may be helpless or injured.
2. Erecting a temporary line or fence to prevent spectators from hindering the work of firemen.
3. Keeping roads, lanes, and service areas open for firemen and their equipment.
4. Providing parking spaces for cars and trucks that are not used for fire fighting.
5. Safeguarding buildings, fences, equipment, gardens, crops, livestock, and articles removed from buildings.
6. Protecting all property against theft or destruction.

Men responsible for guard work should have neighborhood reputations for fairness and integrity. They must command respect and be capable of maintaining cooperation and of performing their duties efficiently and in a friendly manner.

Knowing Kinds of Fires

Firemen must know not only how to rescue people and render first aid but also how to detect differences in kinds of fires and how to use appropriate equipment for each. They should know what causes the fire to burn and what action to take to extinguish fires of different kinds.

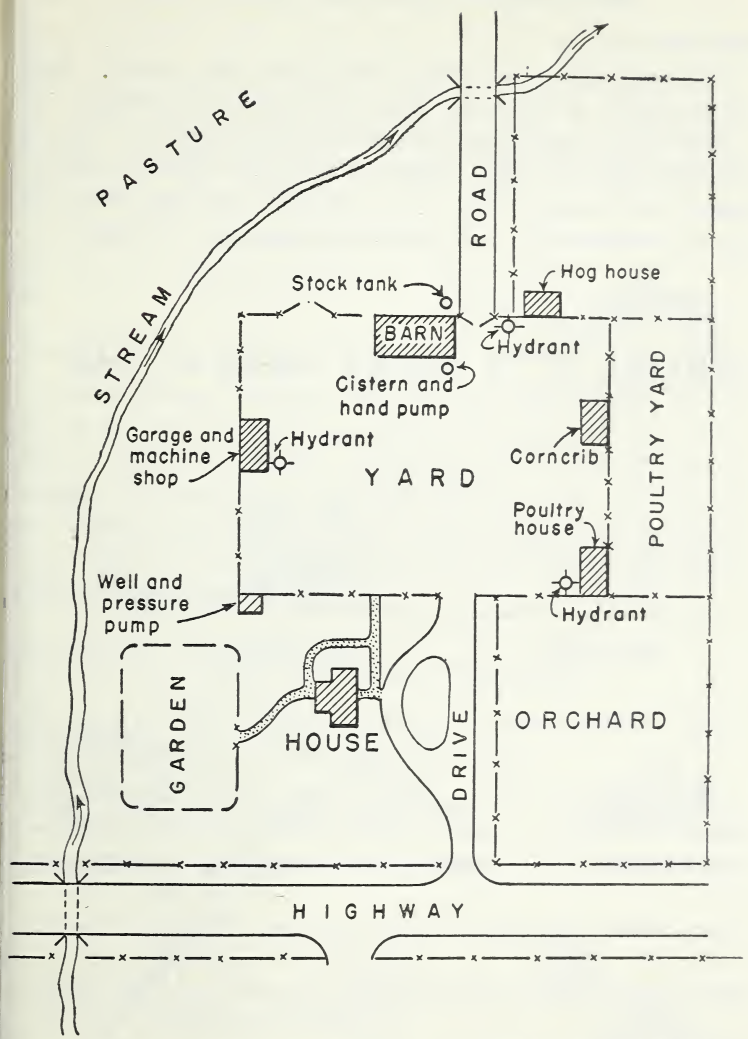

Figure 1.—Simple sketch of a farmstead, showing location of buildings, roads, fences, and water supplies.

Essentials of a Fire

Fire must have three things—fuel, heat, and oxygen. Shut off the supply of any of the three, and the fire will go out.

The factors causing fires are illustrated in figure 2. Fuel is anything that will burn. Different fuels have different temperatures for burning—damp hay and oily rags may heat and ignite spontaneously. Air supplies the necessary oxygen.

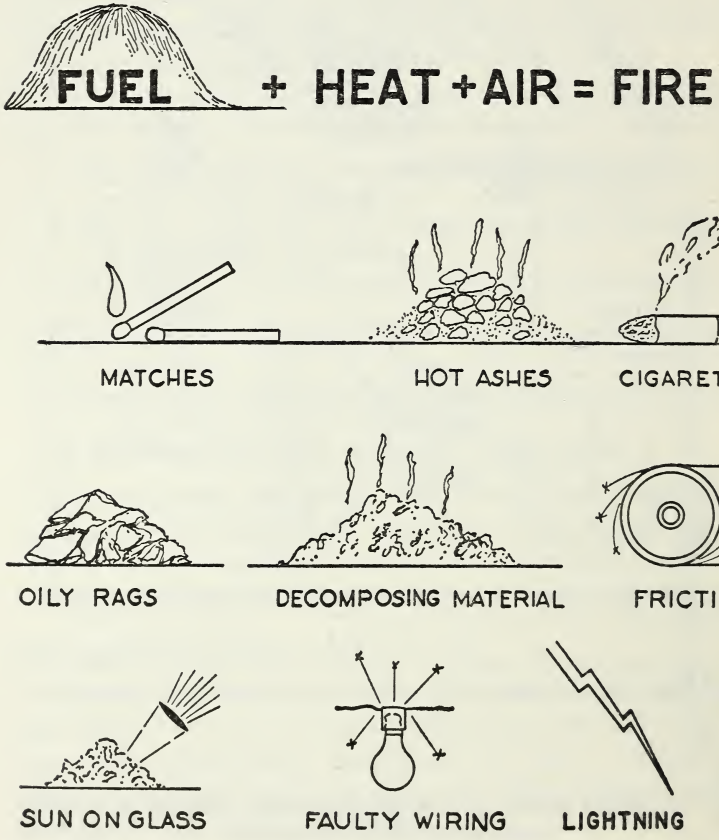

Figure 2.—The essentials for fire and some common causes of fires on farms.

Just as there are three essentials of a fire, so there are three ways of putting it out: (1) It can be starved by removing the supply of fuel. (2) It can be smothered by shutting off the supply of air. (3) The heat can be driven off by cooling to a point where burning will not continue. The three essentials of a fire, and the principles of suppression for each and the results desired, are as follows:

Essentials	*Fire-fighting action*	*Result*
Fuel.....	Remove the fuel.....	Fire starved.
Heat.....	Cool the fire.....	Burning rate reduced and fire extinguished.
Oxygen.....	Cut off the air.....	Fire smothered.

All fire-fighting methods and materials are intended to extinguish the fire by one or more of the actions listed in the second column. Water is effective in fighting wood fires because it cools the fuel and helps to smother the fire. But water is not good with oil fires, because the oil floats and continues to burn. Water supplied under high pressure as a fog, however, is effective in smothering oil fires.

Classification of Fires and Methods of Extinguishing

The science of fire fighting recognizes four classes of fires, based on the nature of their fuel. These are:

Class A. Combustible solids—wood, paper, trash, and other such materials.

Class B. Flammable liquids—gasoline, kerosene, oils, liquids, greases, and fats.

Class C. Electrical equipment—motors, generators, wiring, and heaters.

Class D. Mechanical equipment—automobiles, trucks, tractors, and other power machines.

Fires in each class respond best to certain ways of fighting. The various kinds of fuel and equipment, with suggested methods of extinguishing the fire, are listed by class as follows:

Classes of fire	*Methods of extinguishing*
A. Combustible solids: Wood, Clothing, Paper, Rubbish, Straw	By quenching, with— 1. Water 2. Most types of fire extinguishers
B. Flammable liquids: Gasoline, Kerosene, Fuel oil, Oils and greases, Cleaning fluids	By smothering, with— 1. Dry powder 2. Foam type of extinguisher 3. Vaporizing liquid (when fire is confined) 4. Loaded stream 5. Sand 6. Wet blankets 7. High pressure fog (water) 8. Carbon dioxide 9. Any material that will smother the fire and prevent its spread
C. Electrical equipment: Motors, Generators, Wiring, Heating equipment	By using a nonconducting extinguishing agent— 1. Dry powder 2. Vaporizing liquid 3. Carbon dioxide 4. Fog All materials should be used at a safe working distance from the fire.
D. Mechanical equipment: Automobiles, Trucks, Tractors, Engines	By smothering, with— 1. Dry powder 2. Vaporizing liquid 3. Carbon dioxide 4. Soda-acid 5. Foam

The Nature of Farm Fires

Wooden buildings and large quantities of combustible material increase fire hazards on farms. New hazards accompany the use of electrical equipment, trucks, tractors, engines, and other power equipment. Good lighting and heating equipment, however, lessens the hazards from oil lamps, lanterns, stoves, and fireplaces.

The isolated nature of farms and their distances from town fire companies make the fighting of farm fires difficult. There may be only a few minutes from the time fire begins until it gets out of control. The best period for action is the first 5 minutes. You may have less than 5 minutes to remove people to safety, to give the alarm, and to extinguish the fire.

A few buckets of water, a pail of sand, or a fire extinguisher may be all that is necessary if they are available and are used quickly. The hourglass in figure 3 illustrates how rapidly fire may get out of control—or be extinguished.

TYPES OF WATER EQUIPMENT AND THEIR USE

Buckets

A bucket of water is one of the simplest and best fire extinguishers. The bucket is cheap and can be used in innumerable ways—for drawing, carrying, and storing water. Buckets are convenient for dousing water on the fire and for wetting the roofs and sides of buildings. And bucket brigades are still used effectively.

Common buckets are satisfactory, although fire buckets are preferred. They should be used for no other purposes than fighting fire, they should be marked F I R E, and they should be kept filled. Buckets for fighting fire should be placed near the water supply, near stairs and doors, and at other points convenient to places where fire might occur. Good places for fire buckets are on the second floor of dwellings, near stoves and fireplaces, in the attic, in the basement, and in the washroom, smokehouse, brooder house, stable, granary, machine shed, and garage.

Fire buckets are doubly essential when there is no pressure water system. At least one fire bucket should be kept at each well, pump, spring, cistern, and water barrel. It would be better to have several buckets near each supply. In this way they are ready for instant use. Fire buckets supported by wall brackets are shown in figure 4.

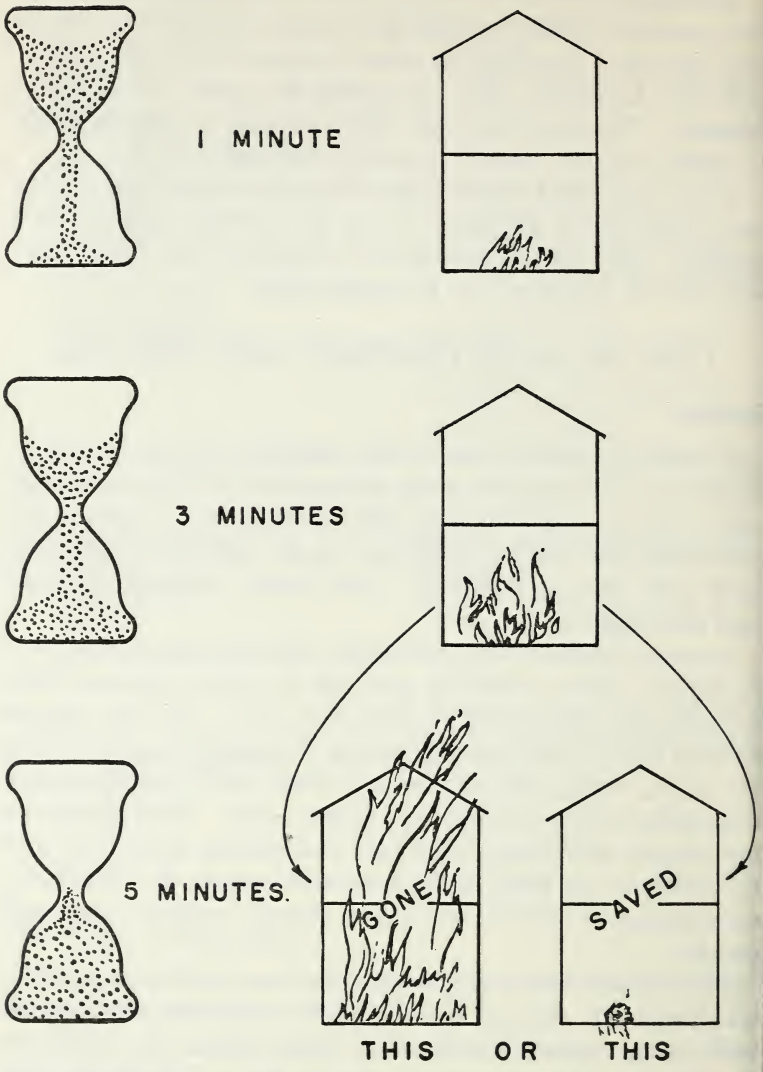

Figure 3.—The hourglass illustrates the short time available to put out the fire or bring it under control.

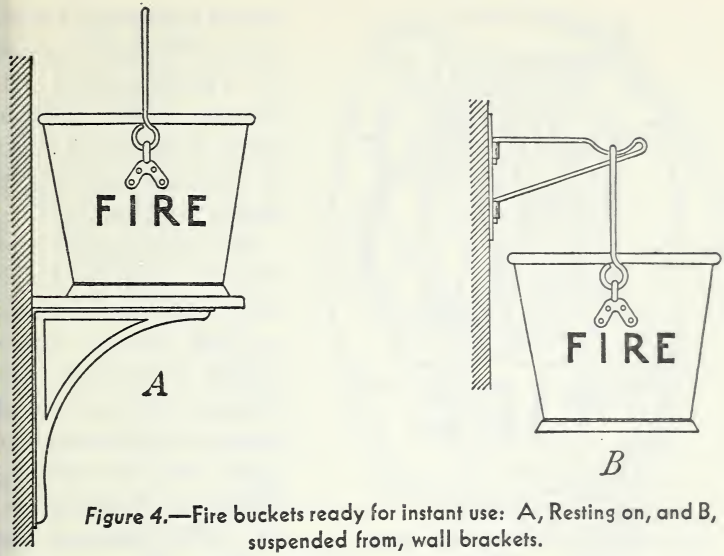

Figure 4.—Fire buckets ready for instant use: A, Resting on, and B, suspended from, wall brackets.

Barrels

Barrels provide good emergency water supplies when they are placed at the house, barn, and other principal buildings. If water is scarce they may be set to catch runoff from the roofs of buildings. In fire protection the value of barrels is increased if three or more fire buckets are nested and sunk in each, as shown in figure 5. Likewise, sacks and old blankets may be kept permanently soaked in fire barrels, as illus-

Figure 5.—Barrel filled with water, and four buckets nested in it.

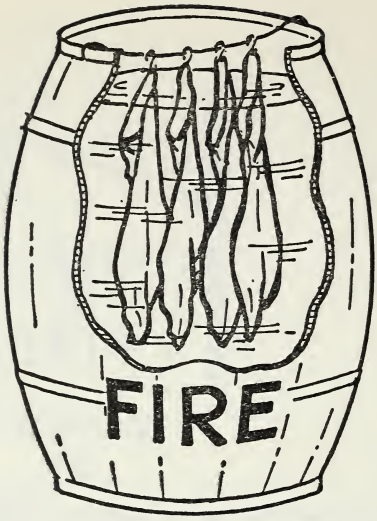

Figure 6.—Barrel with water and sacks.

Figure 7.—Drum and bucket for fire.

trated in figure 6, for use in smothering fires caused by gasoline and oil. Another handy arrangement of drum and bucket for fire fighting is shown in figure 7.

Barrels, casks, and drums may be kept handy for use in transporting water. They should be stored convenient to the source of water or to the wagon or truck used for hauling the water. A small quantity of kerosene on the water will prevent mosquitoes from hatching.

Hand Pumps

The well and cistern pumps that are used for normal farm and home needs must be kept in good working condition to be of value for fire fighting. Time lost in using a balky pump and in hunting for buckets may give the fire a chance to get out of control. Bushings, cylinders, valves, and other critical parts of pumps should be replaced when necessary.

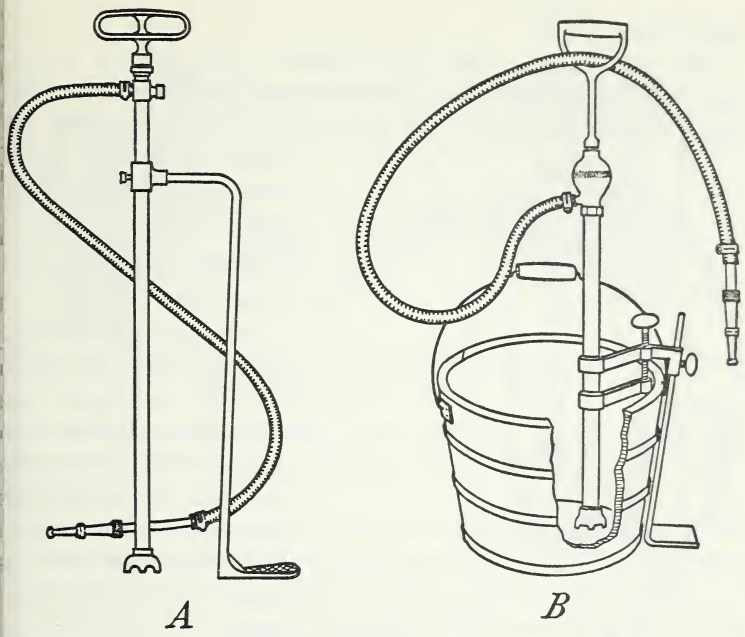

Figure 8.—Stirrup pumps: *A*, Detached for use where needed; *B*, clamped firmly to the rim of a bucket.

Stirrup Pumps

Light, inexpensive stirrup pumps or bucket pumps (fig. 8) may be used to play a continuous stream of water on a fire. In many instances the stirrup pump is better than a fire bucket to force water to the exact place needed. Usually the pump is less wasteful of water than a bucket and it causes less damage to nearby fixtures. The value of the stirrup pump is increased if it can operate continuously. Several helpers may serve as a bucket brigade to keep the pump pail filled.

Stirrup pumps that will develop a pressure of 30 pounds and up can be obtained. Many pumps in good condition will shoot a stream a distance of 30 feet or more. In normal operation they pump about 1½ gallons a minute. They should be checked frequently.

Barrel Pump

The barrel pump (fig. 9) is similar to the stirrup pump, although it is larger and is attached securely to the barrel. The usefulness of the pump will be increased if it is mounted on wheels to permit quick movement to the places where needed.

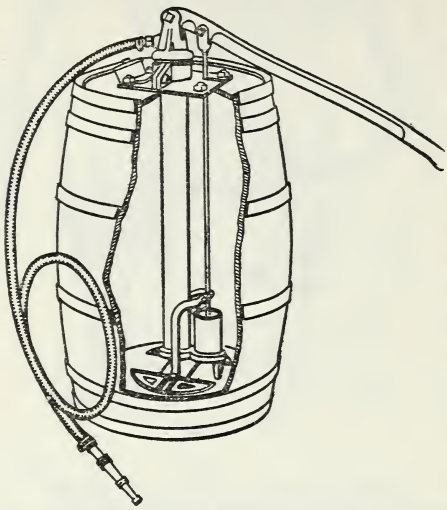

Figure 9.—Barrel pump. Units of this type could be made portable by mounting on cart, wagon, or sled.

Portable Water-Pump Can

The portable water-pump can (fig. 10) combines the features of the fire bucket and the stirrup pump. A filled can holding 4 to 5 gallons of water serves as a ready supply. The pump will throw a stream about 30 feet or more.

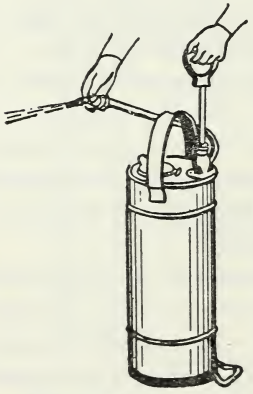

Figure 10.—Portable pump can.

Back-Pack Type Water-Pump Can

The back-pack type of water-pump can is held securely on the back with shoulder straps. It is a complete unit, including can, hose, pump, and nozzle. There are two general types—those operated while the pump is on the back and those removed before pumping.

The plunger "trombone"-type pump (fig. 11, *A*) is operated with two hands while the unit is carried on the back of the operator. The water is pumped and the stream

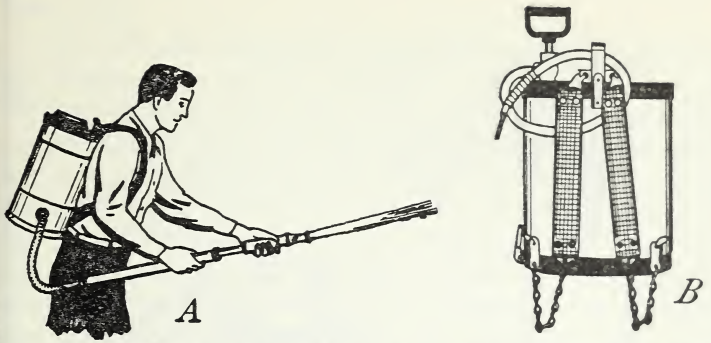

Figure 11.—Back-pack pumps: *A*, Can with trombone-type pump; *B*, standard type, removed from back before using.

directed on the fire in the same operation. Another type has a pump handle that can be operated while the can is carried on the back.

The type of back-pack pump shown in figure 11, *B*, is carried on the back to the fire and removed before using. The fireman pumps with one hand and directs the stream with the other.

The back-pack types of pumps have several advantages: They are cheap, they are self-contained one-man units, they are easily carried, and they are economical in use of water.

Protection From Freezing

All fire pails, tubs, barrels, and pump cans used for storing water must be protected from freezing in winter. This fire equipment may be kept in heated rooms or protected with antifreeze materials—either granulated calcium chloride or flake calcium chloride may be used. Suitable antifreeze mixtures, based on 75-percent granulated calcium chloride, are as follows (minus sign means degrees *below* zero):

Temperature (°F.):	*Calcium chloride, Lb. per gal. water*	Temperature (°F.):	*Calcium chloride, Lb. per gal. water*
10	2¼	−20	4¼
0	3	−30	4¾
−10	3¾	−40	5¼

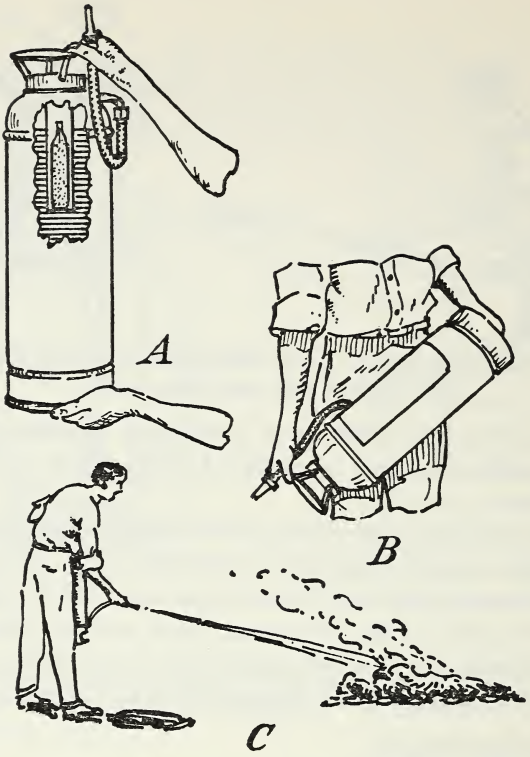

Figure 12.—Soda-acid extinguisher: *A*, Position of hands and manner of grasping to remove extinguisher from wall; *B*, inverted to cause soda and acid to mix; C, extinguisher in use.

CHEMICAL EXTINGUISHERS

Many types of convenient and economical chemical fire extinguishers can be bought. They are clean, safe, and convenient to have in the house, barn, and service buildings. Special kinds are suitable for carrying in automobiles and on trucks, tractors, engines, and other power equipment. Each is designed for a specific service.

Soda Acid

The soda-acid extinguisher is suitable for fighting fires in all the combustible materials included in class A fires. It is not effective against fires in oils, greases, and electrical equipment.

The extinguisher is used by grasping, inverting, and operating as shown in figure 12, *A*, *B*, and *C*. The chemicals—sulfuric acid and bicarbonate of soda—combine to form the pressure for spraying. This extinguisher has a fighting range of 30 to 40 feet. Be sure to protect it from freezing by keeping it in a warm room or heated cabinet. In refilling, use the exact kind and quantity of chemicals and water specified by the manufacturer.

The nozzle of this extinguisher must be kept clean and open. If it should become clogged, pressure may build up and cause an explosion. Safety precautions include frequent inspection, thorough cleaning before refilling, and accurate refilling.

Foam

The foam extinguisher (fig. 13) resembles the soda-acid extinguisher in outward appearance, but it is made and operated on different principles. It contains bicarbonate of soda, water, and a stabilizing agent in an outer compartment, and aluminum sulfate in an inner cylinder. In use the extinguisher is inverted, causing the contents of the two compartments to combine. Chemical action creates the foam and the pressure for discharging it.

The principal value of the foam is for smothering fire. It is particularly well suited to fighting fires in oil and grease (class B) and effective in smothering class A and D fires. It is not

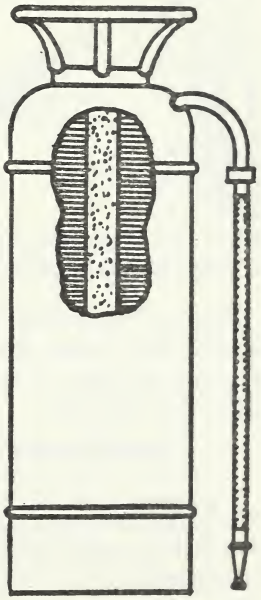

Figure 13.—Foam extinguisher, section removed.

effective on moving liquids. A 2½-gallon foam extinguisher operates about 1 minute and produces 18 to 20 gallons of foam. It is most effective when used 15 to 20 feet from the fire, although it can be used at either close range or at a distance of 30 to 40 feet. Foam extinguishers must be kept in a warm place to prevent freezing and they must be recharged every year.

Vaporizing Liquid

Vaporizing-liquid extinguishers containing carbon tetrachloride are suitable for fighting most classes of fires. They are particularly adapted to class D fires, but are effective also against class B and C fires. They are made in small-gun types of 1- and 2-quart capacity and are convenient to carry in automobiles and on trucks and tractors. A small gun-type extinguisher is shown in figure 14. Large ones are made in 1-, 2-, and 3-gallon sizes.

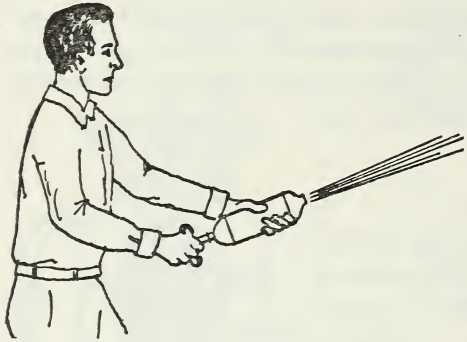

Figure 14.—Vaporizing-liquid (carbon tetrachloride) extinguisher, small-gun type.

These extinguishers are used by pumping the spray directly on the base of the fire. The liquid forms heavy vapors that smother the fire. One quart of liquid expands to about 2½ cubic feet of vapor.

> *Vaporizing-liquid extinguishers should be used with extreme care on account of the danger of inhaling the phosgene gas they give off. This gas is extremely dangerous to man and animals. The extinguishers should not be used in closets or in small poorly ventilated rooms.*

Vaporizing-liquid extinguishers are so designed as not to freeze at temperatures as low as —50° F. The materials should

be changed or partially changed at least once a year, according to the manufacturer's instructions.

Carbon Dioxide

Carbon dioxide extinguishers (fig. 15) are suitable for fighting class B, C, and D fires—particularly those in oil and grease—but are not very effective against deep-seated class A fires. These extinguishers contain 2 to 20 pounds of carbon dioxide. They must be used at short range, usually within 6 to 8 feet of the fire, and with special care in enclosed places.

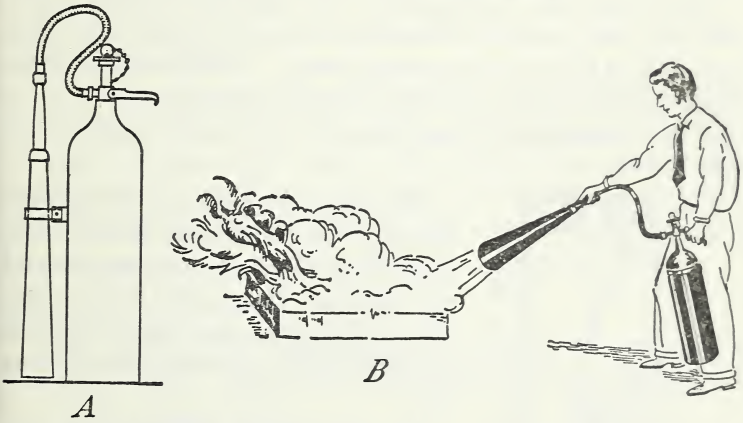

Figure 15.—Carbon dioxide extinguisher: *A*, Ready for use; *B*, in operation.

The liquid carbon dioxide in the cylinder is under a pressure of about 900 pounds per square inch. The pressure is released by opening the valve at the top. The liquid expands in a cloud of heavy gas and snow. In action, the snow, which has a temperature of —110° F., cools the burning material and the vapor smothers the fire.

The need for recharging is determined by weighing the extinguisher. When recharging is necessary the cylinder should be returned to the manufacturer or to a company properly equipped for this service. Extinguishers of this type need not be protected against freezing.

Loaded Stream

The loaded-stream extinguisher uses a solution of chemicals as the extinguishing agent. Since the chemicals have a freezing point of —40° F., they do not need protection against freezing. Pressure is supplied by a cartridge of carbon dioxide. This extinguisher is suitable for use on class A and B fires. It is effective if used at close range, although it may be used 30 to 40 feet away.

Dry Powder

Dry-powder fire extinguishers are of three general types. One uses a dry powder of bicarbonate of soda treated with other materials to keep it from getting lumpy. The powder is in the main chamber, with a cartridge of carbon dioxide (fig. 16). In use, the carbon dioxide expands and forces out the powder in a cloud.

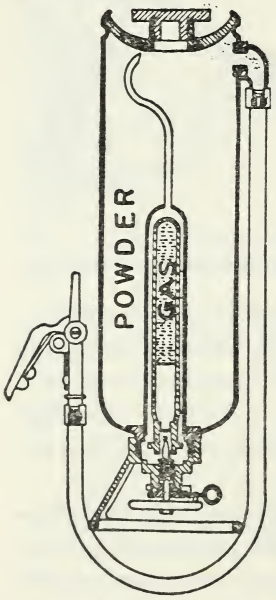

Figure 16.—Section of dry-powder extinguisher.

The other two types are the powder tube and the pump-type duster. The powder tube is used by opening one end and shaking the powder on the fire. The hand pump or dust gun is designed to force a blast of powder dust on the fire.

The dry-powder extinguishers are effective in fighting fires at close range, particularly oil and grease fires (class B). Also, they are suited to fighting fires in electrical equipment (class C). Their value is limited by the small quantity of powder they hold and by the necessity of fighting the fire at close range.

Dry-powder extinguishers have the following desirable characteristics: (1) They are not affected by heat, cold, or

dampness; (2) they can be used effectively indoors and outside; (3) they can be used on a flowing stream of liquid; (4) they can be recharged quickly at the scene of action; and (5) the powder is not poisonous.

DRY COMPOUNDS

Baking Soda

Common baking soda is suitable for small fires in grease and fats, such as those that may occur in the kitchen. The soda can be shaken over the fire.

Sawdust and Soda

A mixture of sawdust and soda forms a compound suitable for fighting class B fires. In making the compound, 10 pounds of soda are thoroughly mixed with 1 bushel of sawdust. The mixture can be used on garage floors and similar oily places to absorb free oils and prevent fires. In case of fire, quantities of the mixture can be spread over the fire to smother it.

Sand, Soil, and Ashes

Sand, soil, and dry cold ashes can be spread on oily surfaces to prevent fires. They are used like the sawdust-soda mixture to smother class B fires.

FIRE-FIGHTING UNITS

Various types of water containers, pumps, and chemical and other fire extinguishers are listed in table 1. The numbers of units suitable for effectiveness are indicated in the last four columns, one column for each of the different classes of fire.

Fire pails, water barrels, and mechanical extinguishers should be placed conveniently for use in case of fire. They should be distributed over the farmstead so that one or more units are located in or near each main building. The number of units available should be such that no point on the farmstead is more than 50 to 100 feet from a fire extinguisher or a fire bucket.

Two or more units of installation may be needed in each of the larger buildings. Part of the fire equipment should be kept on each floor level. Large floor areas may need two or more units, averaging one unit for each 2,500 square feet of floor space.

TABLE 1.—*Types of farm fire-fighting equipment and approximate units for each class of fire*

Type and capacity of extinguisher [1]	Units of protection afforded for fires of class—			
	A	B	C	D
Water containers:				
Fire buckets (12 qt.) (5 per unit)	1	.....	.....	.....
Drum or cask (30 gal.) (with 2 pails)	1	.....	.....	.....
Barrel (50 gal.) (with 3 pails)	1½	.....	.....	.....
Water-pump can (5 gal.) (with 3 pails)	1	.....	.....	.....
Well, spring, or cistern, with hand pump or open top, capacity 500 gal. per hr., within 100 ft. of buildings (with 5 pails)	1	.....	.....	.....
Deep well and hand pump (with 5 pails)	1	.....	.....	.....
Gravity water system (with 5 pails)	1	.....	.....	.....
Pressure water system, capacity 500 gal. per hr., 40-lb. pressure (with 100 ft. of ¾-inch hose and 5 pails)	2	.....	.....	.....
Pressure water system, capacity 1,000 gal. per hr., 40-lb. pressure (with 200 ft. of 1-inch hose and 10 pails)	4	.....	.....	.....
Chemical extinguishers:				
Soda acid (2½ gal.)	1	.....	.....	½
Foam (2½ gal.)	1	1	.....	1
Vaporizing liquid (4 qt.)	.....	1	1	1
Carbon dioxide (12 lb.)	1	1	1	1
Loaded stream, nonfreezing type (2½ gal.) (2 per unit)	1	1	.....	.....
Dry compounds (and quantity or capacity):				
Bicarbonate of soda (15 lb.)	½	1	1	1
Sand pails (3 gal.) (10 per unit)	.....	1	.....	1
Sawdust (2 bu.) and bicarbonate of soda (20 lb.)	.....	1	.....	.....

[1] Pressure water systems and pumps must be properly installed to prevent freezing. Pumping plants should be housed in a separate building 50 feet or more from the house and the barn. Electric pumps should have their own circuit separate from the power supplying the service buildings.

SUPPORTING EQUIPMENT

Ropes, rope tools, and ladders are needed to get the fire fighters, water, and chemicals to the right spot. These hand tools are as essential equipment as fire extinguishers and water.

Rope

Some of the many uses for rope in fire fighting are: (1) For emergency fire escapes; (2) to draw water from open wells, cisterns, streams, and ponds; (3) to pull up hose, ladders, and other equipment; (4) to rope off enclosures for penning livestock; and (5) to establish a line to keep traffic and people from blocking the fire-fighting area.

It is better to have some suitable ropes for fire fighting only, though farm ropes also are often useful. Valuable time may be lost, however, in hunting for them and in removing them from haymows or other storage places. A good all-purpose hand line can be made from 100 feet of ⅝-inch rope. Ropes used in fire protection need frequent inspection to make sure that they are sound, safe, and have not been damaged by exposure or gnawed by rodents. To use a damaged rope at a fire may result in disaster.

Rope Tools

Rope tools (fig. 17) are widely used by firemen in pulling up hose lines and ladders for use on the roof, floor, or window. Similarly, rope tools are useful for hoisting ladders, hand tools, cans and buckets of

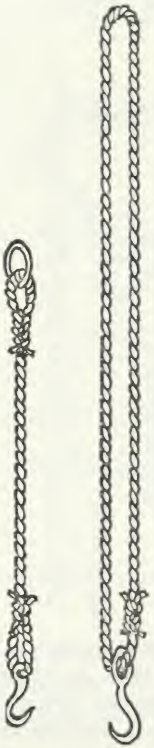

Figure 17.—Two types of rope tools.

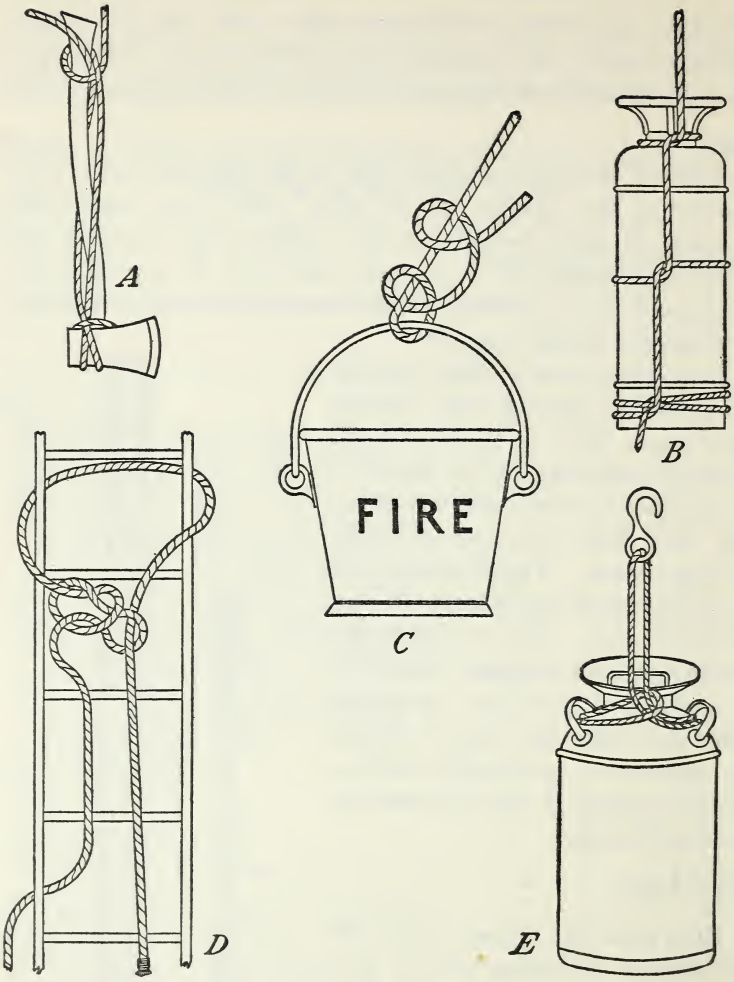

Figure 18.—Tying ropes for hoisting fire-fighting equipment: *A*, Double loop tie on ax; *B*, clove hitch and two half hitches on fire extinguisher; C, chimney hitch on fire bucket; *D*, bowline over end of ladder down one-third its length; *E*, rope tool on milk can.

water, and fire extinguishers and for lowering valuable materials to safety.

Skill is needed in the use of rope in an emergency. Methods of tying and using them for hoisting axes, fire extinguishers, buckets, ladders, and milk cans are shown in figure 18. It is well to know how to tie quickly and surely a few good knots, such as those shown in figure 19.

Selection and Care of Ropes

Correct sizes of rope should be used to prevent accidents to persons and damage to the rope itself and to other kinds of property. Following are safe working strengths of rope:

Diameter:	*Safe load*	
	Manila	*Sisal*
Inch	*Pounds*	*Pounds*
¼	100	70
⅜	200	140
½	400	280
¾	980	686
1	1,640	1,148

The life and usefulness of rope will be prolonged if the following points are observed:

1. Unwind properly to prevent kinks.
2. Do not pull out kinks.
3. Do not overload or pull over sharp corners.
4. Protect from acids and chemicals.
5. Store in a well-ventilated building on a slatted floor, or hang in loose coils over wooden pegs.
6. Protect from sun, rain, dampness, and heating equipment.
7. Keep it away from rats and mice.
8. Dry wet rope in the shade.
9. Protect wet rope from freezing.
10. Store where it will be convenient in fire fighting.

Ladders

Dependable ladders are needed in fighting fire. An assortment of different sizes and types should be provided for carrying on rescue work, fire fighting, and fire protection at the same time.

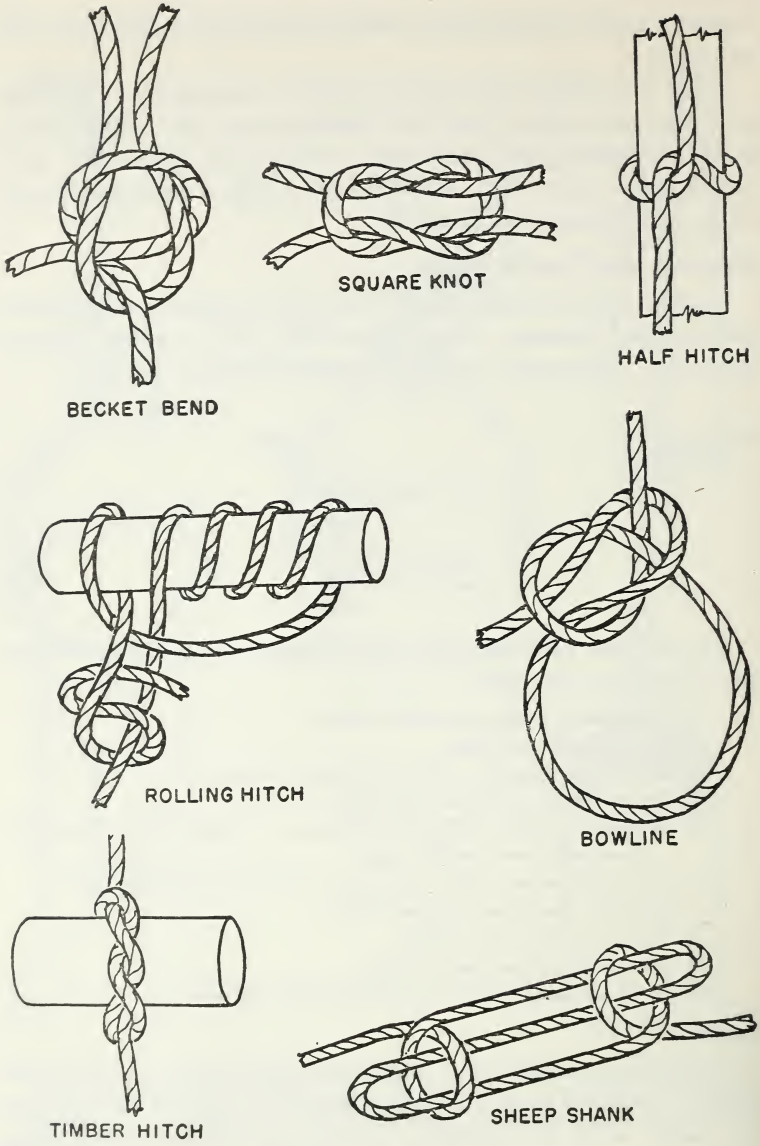

Figure 19.—Rope knots.

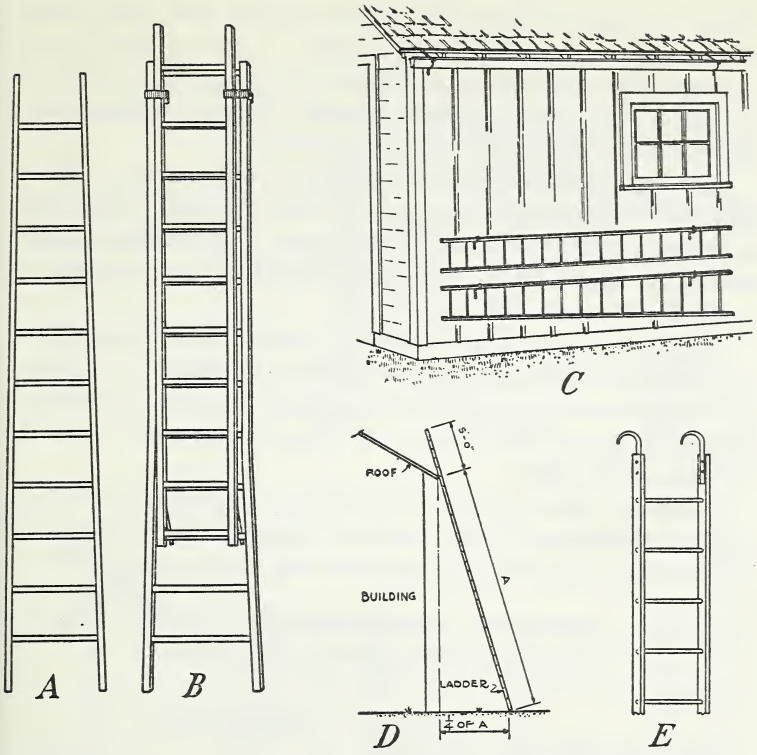

Figure 20.—A, Straight ladder; B, extension ladder; C, ladders on side of building; D, setting the ladder; E, roof ladder with hooks.

Single ladders (fig. 20, *A*) are inexpensive and easily made. A number of them should be kept primarily for fighting fire. The sizes should be such as to reach the roofs of one-story buildings and second-floor windows. At least one sturdy ladder should be long enough to reach the roof of the tallest building. Many farmers have extension ladders (fig. 20, *B*) that are suitable for fighting fire if kept handy and in good operating order.

Ladders are most convenient for fire fighting if they are hung on the outside walls of buildings. Their usefulness is increased

if they are kept in convenient places together with ropes, water-buckets, barrels, and fire extinguishers. Ladders stored on the outside walls of buildings, as illustrated in figure 20, *C*, should be protected with oil or varnish instead of paint, because paint hides cracks, knots, and other weaknesses.

Ladders should not be set too straight or too slanting. Generally, the bottom should be set away from the wall or eavesdrip a distance equal to one-fourth the length of the ladder, as illustrated in figure 20, *D*. Ladders should be long enough to extend 4 to 5 feet above the eaves.

The approximate sizes of ladders needed for getting on roofs of buildings of different heights are shown in table 2. Comparative measurements are given as a guide for setting the ladders. Standard lengths of ladders are given in footnote 2, at the bottom of the table.

Ordinary ladders can be converted to roof ladders by attaching iron hooks to the top ends, as illustrated in figure 20, *E*. This ladder can be hooked over the ridge of the roof.

TABLE 2.—*Approximate measurements for selecting length of ladders and their position on the ground*

Height of building from ground to eaves (feet)	Distance from wall [1] to bottom of ladder	Length of ladder		Total length [2]
		Below eaves	Above eaves	
	Feet	*Feet*	*Feet*	*Feet*
10	2½	10½	4½	15
15	4	15½	4½	20
20	5	20½	5½	26
25	6½	26	5	31
30	8	31	5	36
35	9	36	5	41
40	10	41	5	46
45	11½	46½	5½	52

[1] Width of eaves should be added to figures in this column.

[2] Standard lengths of ladders are 12, 14, 16, 20, 24, 26, 28, 30, 32, 35, 40, 45, 50, and 55 feet.

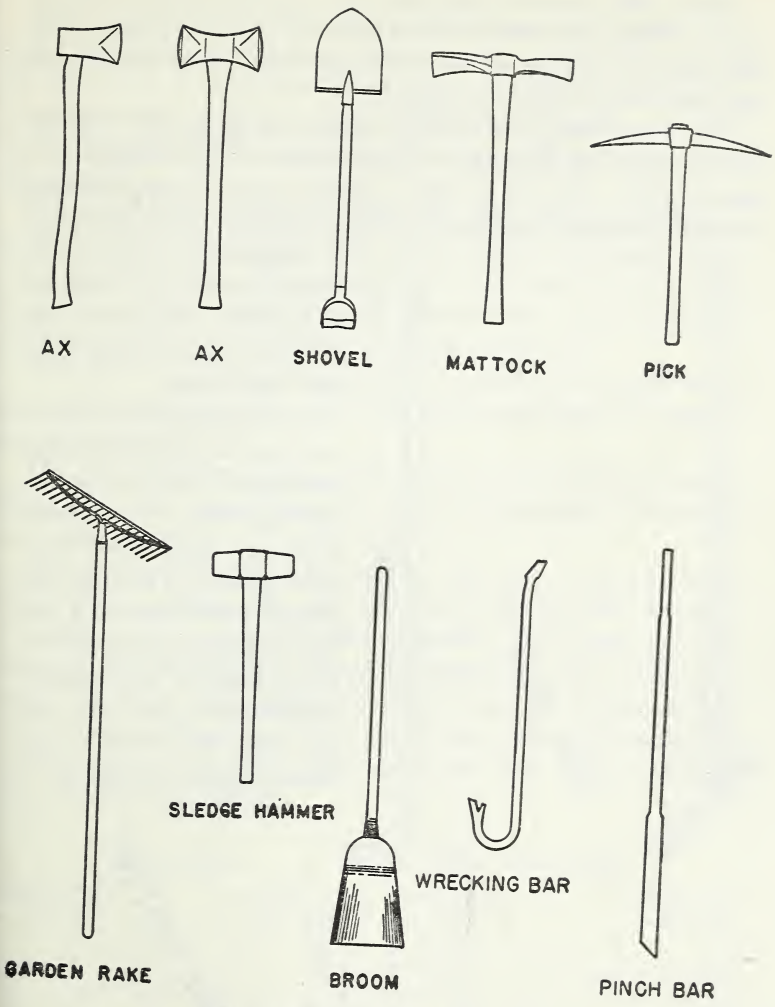

Figure 21.—Farm tools suitable for fighting fire.

Hand Tools

Many farm tools are suitable for opening doors, windows, walls, ceilings, and roofs and for use in the various phases of fire fighting and salvage work. Common farm tools suitable for fighting fire are shown in figure 21.

Two other handy fire tools are shown in figure 22. The fire rake is made by attaching a long handle to four sections of a mower knife. The fire swatter is simply a piece of heavy belting or similar material attached to a long handle. These tools can be bought, or they can be made in any shop. They are particularly suited to raking fire lanes and swatting grass and forest fires.

In some neighborhoods or on large farms it may be advantageous to have the fire-fighting tools in a separate building. Each tool, however, should be in its proper place whether kept in a special building or elsewhere. Every member of the family should know where the tools are kept and how to get them in any emergency.

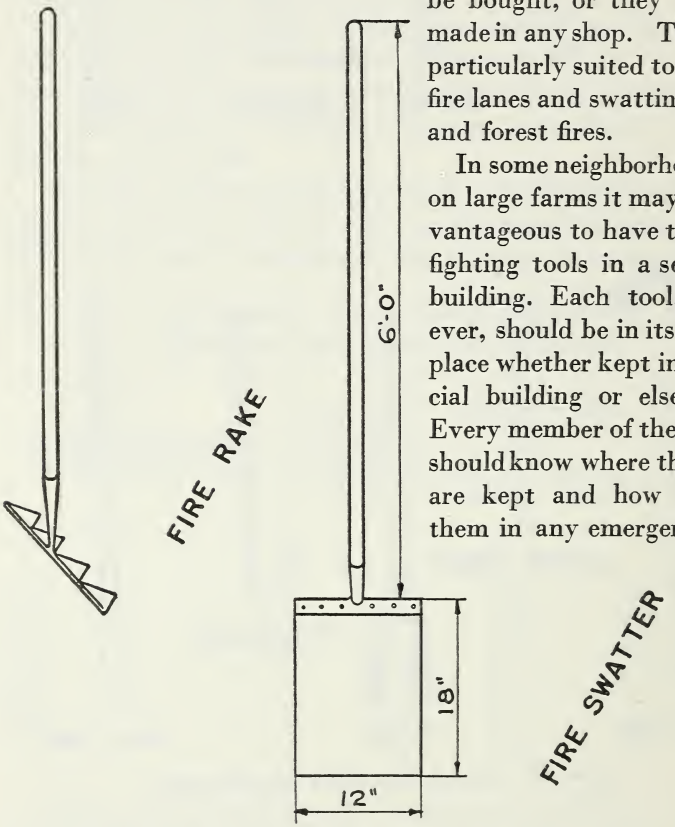

Figure 22.—Handy fire tools, fire rake and fire swatter.

Since most farms do not have enough water for fighting fire, water supplies should be measured. In some instances the quantity can be increased by adding storage tanks, barrels, cisterns, ponds, and reservoirs. Where water tables are close to the surface, shallow wells can be dug or drilled for an additional supply.

Plans can be developed to fight fire with small quantities of water if fire extinguishers and high-pressure pumping equipment are available. In any case, it is necessary to know how much dependable water is available and how much is needed to operate various types of fire-fighting equipment.

The flow of water from springs can be measured in gallons per minute by dipping the water out and recording the time of replacement flow.

The flow of water in deep wells can be measured by pumping them dry or by determining the rate of discharge of the pump in gallons per minute.

The flow and capacity of shallow wells can be measured by dipping or pumping the well dry and recording the quantity of water removed and the time required. The total quantity removed less the amount of water displaced in the well represents the flow. The water displaced may be determined by measuring the draw-down of water in feet and multiplying this by the gallons per foot depth for round and square wells of different sizes, as follows:

Round Wells	
Diameter (in inches)	*Gallons per foot depth*
6	1.5
9	3.3
12	5.9
18	13.2
24	23.5
30	36.7
36	52.9
48	94.0

Square Wells	
Dimensions (in inches)	*Gallons per foot depth*
12 x 12	7.5
18 x 18	16.8
24 x 24	29.9
30 x 30	46.8
36 x 36	67.3
48 x 48	119.7

The storage capacity of round and square tanks and cisterns with straight sides is given in tables 3 and 4.

TABLE 3.—*Capacity of round cisterns and tanks with straight sides*

Depth (feet)	Diameter (in feet)					
	4	6	8	10	12	14
	Gals.	*Gals.*	*Gals.*	*Gals.*	*Gals.*	*Gals.*
4	376	846	1, 504	2, 350	3, 384	4, 606
6	564	1, 269	2, 256	3, 525	5, 076	6, 909
8	752	1, 692	3, 008	4, 700	6, 768	9, 212
10	940	2, 115	3, 760	5, 875	8, 460	11, 515
12	1, 128	2, 537	4, 511	7, 050	10, 152	13, 818

TABLE 4.—*Capacity of square cisterns and tanks with straight sides*

Depth (feet)	Size (in feet) measured at bottom or top				
	4 x 4	6 x 6	8 x 8	10 x 10	12 x 12
	Gals.	*Gals.*	*Gals.*	*Gals.*	*Gals.*
4	480	1, 080	1, 920	3, 000	4, 320
6	720	1, 620	2, 880	4, 500	6, 480
8	960	2, 160	3, 840	6, 000	8, 640
10	1, 200	2, 700	4, 800	7, 500	10, 800
12	1, 440	3, 240	5, 760	9, 000	12, 960

Ponds and reservoirs are more difficult to measure because they are large and usually have irregular bottoms and sides. Their storage capacity in gallons can be determined approximately by multiplying the average length by the average width by the average depth in feet and the product by 7.5 (the number of gallons in 1 cubic foot).

The flow of creeks, branches, runs, and other small streams can be found by building a small earth dam and measuring the volume that passes through a trough or pipe into a bucket or barrel.

Pressure Water Systems

Three general types of pressure water systems are used on farms: The gravity system, the pneumatic system, and the pneumatic system with a pressure storage tank. This classification is based on water pressure and water delivery, whether the pumping is accomplished with an electric motor, engine, hydraulic ram, or windmill, or whether the water flows by gravity from a higher elevation.

The pressure head is measured in terms of feet elevation of the supply or in pounds per square inch. Pressure in pounds may be converted into its equivalent in feet elevation by referring to table 5. Likewise, elevation in feet may be converted to pressure in pounds, using the same table.

TABLE 5.—*Water-pressure equivalents in pounds and elevation*

Elevation (feet)	Pressure per square inch	Elevation (feet)	Pressure per square inch	Elevation (feet)	Pressure per square inch
	Pounds		*Pounds*		*Pounds*
5.....	2.2	40.....	17.3	120.....	52.0
10.....	4.3	50.....	21.7	140.....	60.7
15.....	6.5	60.....	26.0	160.....	69.3
20.....	8.7	80.....	34.7	180.....	78.0
25.....	10.8	100.....	43.4	200.....	86.7
30.....	13.0				

Most farm water systems are not of sufficient size and capacity to provide adequate fire protection. Some of their limitations are indicated as follows:

Too little water
Pump too small
Engine hard to start
Wind insufficient for windmill operation
Electric system not housed in a separate building
Electric-pump motor not on a separate circuit from buildings
Water tanks too small
Pressure supply tanks too small and pressure too low
Pipe system too small
Pipes frequently partially filled with rust, silt, or other material
Taps not located conveniently to buildings
Hose too short, too small, not in good condition
Water system not adequately protected against freezing

A small stream of water flowing steadily for the greater part of the day may be ample for several families and a large number of livestock. In fighting fire, however, it may be of little value if a large quantity of water is needed quickly.

In city fire fighting the standard fire stream using a 1⅛-inch nozzle and 45 pounds' pressure requires 250 gallons per minute, or 15,000 gallons per hour. At this rate a tank or cistern 14 feet in diameter and 13 feet deep will be emptied in an hour.

Smaller than standard hose may be effective in protecting farm property if there is not enough water storage for a standard fire stream. The smaller stream may be estimated as using 50 to 100 gallons per minute through a 1½-inch hose. On this basis, a cistern or tank 8 feet square and 8 feet deep would keep the smaller outfit pumping ½ to 1 hour.

Small farm water systems usually are helpful in filling buckets and fire extinguishers. But unless the water supplies are measured, they should not be relied upon to furnish adequate water under pressure for extinguishing a fire, especially if the fire is near the top of tall buildings.

Fog and High-Pressure Fog

Many power sprayers used for protecting fruits and vegetables are effective in fire fighting. Such sprayers frequently develop 300 to 600 pounds' pressure. If properly equipped with hose, gun, and fog nozzles these sprayers can be used with less water than is required with low-pressure equipment. Fog nozzles

can be used with pressures as low as 80 to 100 pounds, but they are increasingly effective as the pressure is increased. Some high-pressure equipment maintains a pressure as high as 600 pounds per square inch at the nozzle.

Farm power sprayers used for fire fighting must be properly cared for. The tires, engine, pump, valves, pipe, hose, and gun must be kept in good condition. These sprayers must be protected from freezing, both in storage and while being operated. Flake calcium chloride should be used for this purpose. The quantity of calcium chloride needed to protect water from freezing at various temperatures is shown on page 15. A supply of the calcium chloride solution may be made in advance and held in concrete or wooden tanks or in barrels until needed. The sprayer should be thoroughly cleaned and drained after it has been used.

TOWN FIRE EQUIPMENT

Most town fire companies respond to farm fire calls within practical travel distances. In many instances town and farm people cooperate in maintaining and using rural fire-fighting equipment.

The types of rural fire equipment frequently used include pumps with capacity ranging from 50 to 500 gallons per minute. The small pump needs a supply of 3,000 gallons an hour. The larger pump would require 10 times this quantity, or 30,000 gallons. If a large stream, pond, or reservoir is within 500 to 700 feet of the fire, the large pumper can be used. A road or lane should be opened to the water supply and so graded that the fire pump will be on a solid foundation and not more than 15 feet higher than the water level. The distance for direct pumping should be checked against the length of suction hose carried on the pumper.

Town firemen going to the farm may take chemical pumps, hand-operated fire extinguishers, ladders, tools, pumps, and tanks of water. In using the equipment, the first essential is ample water for either direct pumping or for refilling water tanks.

SPECIAL EQUIPMENT FOR FARM FIREMEN

Farm fire associations may benefit by purchasing or building special equipment for fighting fires. Many types of pumps and chemical extinguishers are made in sizes suitable for transporting from farm to farm on small trucks or trailers. The following sizes and types of fire equipment might be considered:

Fire alarms: (1) Telephone system for giving fire alarms. (2) Sirens located at central points.
Tanks and pumps: One 300-gallon tank and pump with capacity of 30 gallons per minute at 120 pounds' pressure.
Soda-acid extinguishers on wheels: 20- to 40-gallon sizes.
Antifreeze-extinguisher type on wheels: 20- to 40-gallon sizes.
Foam types on wheels: 10-, 20-, and 40-gallon sizes.
Vaporizing liquid (carbon tetrachloride): 1-, 2-, or 3-gallon sizes.
Carbon dioxide extinguishers on wheels: 50-, 75-, and 100-pound sizes.
Loaded stream on wheels: 20 to 40 gallons.
Dry-compound extinguishers on wheels: 150 to 350 pounds.
Special hose, guns, and fog nozzles for high-pressure sprayers.
Extra supplies of buckets, barrels, hose, pump cans, portable fire extinguishers, ladders, rope, and hand tools.
Power pumps and engines, portable tanks, and accessories.

The chief of the town fire department should be consulted for suggestions on the types and sizes of fire equipment most suitable for the farm neighborhood. In this way, information can be obtained on new types. Selection can then be made to supplement the equipment already available in both town and rural areas.

FIRE-FIGHTING PLANS

Fire-fighting plans and methods must be adjusted to the water supply and pumping equipment.

Buckets, hand pumps, milk cans, sprinkling cans, tubs, and fire extinguishers can be used effectively when the water supply is limited to small springs, wells, cisterns, and rain barrels. Drums, casks, barrels, and milk cans can be held ready to transport additional water from the nearest source of supply.

Where the farm water supply includes strong wells or springs or large ponds or reservoirs, and power-pumping equipment is

available, the fire-fighting plans should include the use of these water supplies and the town fire-fighting equipment.

If the farm neighborhood is not adequately equipped to fight fire, more dependence should be placed upon using the facilities of the nearest town fire company. Generally, town fire companies have adequate auxiliary fire-fighting equipment in addition to the large pumpers. Such equipment includes light hand- and portable-type chemical extinguishers and small engines with portable supplies of water. In many cases the fire can be extinguished with the small equipment without using large fire engines and large quantities of water.

FIGHTING FARM FIRES

Fighting fire on farms may be considered from three angles: (1) What the family can do before help arrives; (2) what the family and neighboring farm firemen can do using the farm equipment and that which the neighbors bring; and (3) how they can support the firemen from town fire companies.

All members of the family need be well informed and trained to work together quickly and efficiently the first 5 or 10 minutes until assistance arrives. The essentials are:

1. Reach safety.
2. Rescue the helpless.
3. Send out a fire alarm.
4. Determine the location, class, and extent of fire.
5. Fight the fire.
6. Hold the fire in check until help arrives.
7. Remove livestock from threatened structures.
8. Protect other buildings.

When farm firemen arrive, it will be necessary to organize and direct their efforts and supply them with available fire-fighting equipment. Responsible persons should be placed in charge of—

1. Guarding the fire and directing traffic.
2. Fire fighting.
3. Salvaging.
4. First aid.

Under this organization the following duties are divided and carried on at the same time:

Guards

1. Keep trafficways open.
2. Keep work area open for firemen and fire-fighting equipment.
3. Keep water supplies accessible.
4. Keep roads, lanes, fences, and gates open to reach ponds, streams, lakes, and other water supplies.
5. Keep the crowd back a safe distance.
6. Protect injured and helpless.
7. Protect from damage all roads, fences, gates, equipment, garden, field crops, and fire-fighting equipment.
8. Direct the parking of cars and trucks.

Salvage Crew

During the fire:

1. Remove livestock from buildings to pastures or fields.
2. Remove essential pieces of property.
3. Find location of fire.
4. Protect valuable furnishings, equipment, supplies, and produce from unnecessary damage from fire, water, and fire-fighting operations.
5. Protect nearby buildings from catching fire.

After the fire (overhaul):

1. Guard against recurrence of the fire.
2. Mop up and clean up the buildings for use.
3. Make temporary repairs of roofs and other damaged parts.
4. Restore supplies, equipment, and furnishings to their proper places.
5. Return livestock to stables or suitable temporary quarters.
6. Clean and return fire-fighting equipment to the owners.
7. Look after emergency needs of the family.

Fire Fighters

While responsible persons are carrying on guard and salvage work, the fire fighters can give their full effort to the business of fighting the fire, as follows:

1. Rescue persons.
2. Administer first aid to the injured.
3. Determine the class of fire and proper equipment to use.
4. Assemble and use the best equipment available.
5. Send for additional assistance and equipment as required.
6. Direct the fire-fighting work.
7. Check and direct guard and salvage work.

ORGANIZATION OF FARM FIRE FIGHTERS

Normally the organization of the farm fire fighters should include 6 to 20 farms. Large farms, plantations, and ranches may have several fire-fighting units. In neighborhoods of this size, there should be 10 to 30 farm men who may organize for training. Also, there may be approximately the same number of farm women and larger boys and girls to assist the fire fighters.

A fire-fighting crew should include 10 to 12 trained firemen and 10 to 12 others to aid and support them. Suggested organization for neighborhoods of different sizes are indicated as follows:

	Small	*Medium*	*Large*
Number of farms	6 to 10	11 to 15	16 to 20
Approximate number of fire fighters	10	20	30
Fire chief	1	1	1
Assistant chiefs	1	1	2
Captains	1	2	3
Lieutenants (guard)	1	2	3
Lieutenants (salvage)	1	2	3
Firemen	5 to 7	12 to 14	18 to 22
Assistants (women, boys, and girls)	8 to 10	12 to 20	25 to 30

In fighting the fire, the following organization is suggested for crews of 10 to 12:

Fire chief (or assistant chief)

1 guard lieutenant	1 captain	1 salvage lieutenant
1 assistant	5 to 7 firemen	1 assistant

10 to 12 assistants—women, boys, and girls

The organization should be kept simple, friendly, and neighborly. The chief and other leaders should be selected for their ability, sincerity, tact, and leadership. Thorough training should be given to all firemen. Assistants should be trained to act quickly in emergencies and to aid the firemen.

Duties of Fire Chief

The selection of assistants, the training of firemen, and the direction of all fire fighting is the responsibility of the fire chief.

Among other duties and responsibilities the chief should—

1. Develop an efficient organization.
2. Arrange for fire-fighting equipment.
3. Develop a system of fire alarms.
4. Develop with each farm operator a fire-fighting plan suitable for his particular farm.
5. Arrange for the protection of schools, churches, and other public buildings.
6. Arrange for the cooperation and support of town fire companies and forest fire wardens.
7. Provide training courses for firemen covering:
   a. Causes of farm fires.
   b. Nature and use of fire-fighting equipment.
   c. Fire-fighting principles and practices.
   d. Organization of fire companies.
   e. Fire guarding.
   f. Salvaging.
   g. First aid.
   h. Educational programs to remove farm fire hazards.
   i. Training women, boys, and girls as auxiliary firemen.
   j. Training farm people to act wisely in case of fire.
8. Respond to all farm fires and direct the fire fighting.
9. Arrange with fire chiefs in adjoining neighborhoods for cooperative training of firemen for borderline fires.

FIRE-FIGHTING PRINCIPLES AND PRACTICES

When a fire is reported the initial action should follow these steps:

1. Send out fire alarm and relay the alarm to others.
2. Go straight to fire with the equipment available from each farm.
3. Remove people from the burning building.
4. Shut doors and windows to hold fire to the room or closet where it has started (closing the room shuts off the draft and part of the oxygen supply).
5. Locate and put out fire if possible with available help and fire-fighting equipment.
6. If fire cannot be extinguished without additional help, keep doors and windows closed until assistance arrives.
7. Protect other buildings, livestock, and property.

Small Fires

The fire caught in the beginning may be fought in the following manner:

Locate the fire and determine its class (A, B, C, or D).

Class A (combustible materials). Fight with water or any chemicals available or smother with sand and wet sacks. Apply water at the base of the fire.

Class B (oils and grease). *Do not use water.* Smother with foam or vaporizing liquid or with carbon dioxide, bicarbonate of soda, sand, or soda-treated sawdust.

Class C (electric services, motors, and appliances). *Do not use sand and water.* Shut off current if possible and smother with vaporizing liquid, carbon dioxide, or bicarbonate of soda.

Class D (automotive and other mechanical equipment). Smother with vaporizing liquid, foam, carbon dioxide, or bicarbonate of soda. Use other methods and equipment according to the nature of the fire.

REMEMBER: *Wood, trash, and other combustible solids are class A; gasoline, oil, and grease are class B; and electric wires, batteries, motors, and generators are class C; tractor fires are class D. Each should be fought with the equipment recommended for its specific class* (*see p. 8*).

Spontaneous Ignition

Damp hay, grain, straw, manure, sacks, and trash may heat and smoke. This is a slow burning by oxidation. Spontaneous ignition occurs when these materials get so hot that they catch on fire. Similarly, old clothing, mops, and oily rags may heat and cause a fire.

Fires caused by spontaneous ignition are fought in the same manner as those started in other ways. The method of fire fighting is determined by the class of materials burning. In most instances fires caused by spontaneous ignition are class A fires. Oily mops, greasy rags, and the like, however, would cause the fires to be a combination of classes A and B.

The nature of spontaneous ignition is such that warning is usually given by smoke, gas, heat, and odors before flames are

seen. The following precautions should be taken to prevent a fire when these conditions are discovered:

1. Get fire-fighting equipment ready—water, carbon dioxide, and soda.
2. Soak the smouldering materials to cool them.
3. *Open up materials cautiously,* because they may burst into flame as additional air is admitted.
4. Remove smouldering materials cautiously to a safe open space away from buildings.

In removing hot hay, firemen must be careful to keep from falling into holes burned deep in a mow. The temperature of the hay may be found by putting a thermometer in a pipe and forcing the pipe into the hot hay. The pipe and thermometer should remain in the hay about 15 minutes before they are withdrawn. The temperature should be read immediately and checked against the following temperature guide:

140° to 150° F. Observe hay condition.
160° to 170° F. Observe hay closely and take temperature readings twice a day.
180° to 190° F. Remove hay carefully—shut off ventilation.
195° to 200° F. Soak hay and remove cautiously to a point far enough from the building to prevent a fire if the hay should ignite.

If it is not convenient or safe to remove hay or other materials subject to spontaneous ignition, the mass may be cooled with carbon dioxide, applied either with a fire extinguisher or in the solid form known as dry ice. The action of dry ice is cooling to the mass of materials and smothering to the burning embers, thus preventing their bursting into flames.

Ventilation

Ventilation of burning buildings or rooms increases the supply of air (oxygen) and usually causes the fire to burn faster. But ventilation may be necessary to get rid of excess smoke and gases before the fire can be reached. Generally the following practices are used:

1. Remove people quickly and cautiously.
2. Close door or window when leaving a room.
3. Keep doors and windows shut until firemen and equipment are ready to begin work.
4. When ventilation is necessary, *open door or window cautiously, because air may rush in and supply sufficient oxygen for an explosion.* (Openings should be above the fire, near the roof or ceiling line and on the side opposite from the wind.)
5. When the excess smoke and gas have drifted out and the fire has been located, water or suitable chemicals should be applied at the base of the fire.
6. If the fire is in the floor, wall, or ceiling, suitable openings should be made to apply water or chemicals directly on the fire.
7. In opening buildings either for ventilation or for fire fighting, care should be used to prevent injury to the firemen doing the work, and the property should not be damaged more than necessary.

Doors and windows should be pried open instead of being broken open. Necessary cuts in floors, ceilings, walls, and roofs should be made carefully between joists, studs, and rafters so that they can be repaired. Figure 23 shows how to use an ax in prying open a locked door and a locked window and how to open a roof or floor or break a window.

Never stand in front of a door or window when it is being opened—the inrush of air and oxygen may cause an explosion.

Grass Fires

Grass fires are responsible for a large part of the farm fire losses because they spread to woodlands, forests, and farmsteads.

Prevention is the best control. Keep the grass mowed and raked away from buildings and fences, and build firebreaks between grass fields, forests, and woodlands. Firebreaks can be established quickly by using plows, disks, drags, harrows, or mowers drawn by horses, tractors, trucks, or automobiles.

Grass fires are extinguished by plowing, mowing, or raking firebreaks, by quenching with water, or by backfiring. When the fire occurs on sandy or loose soil, a shovel is useful for

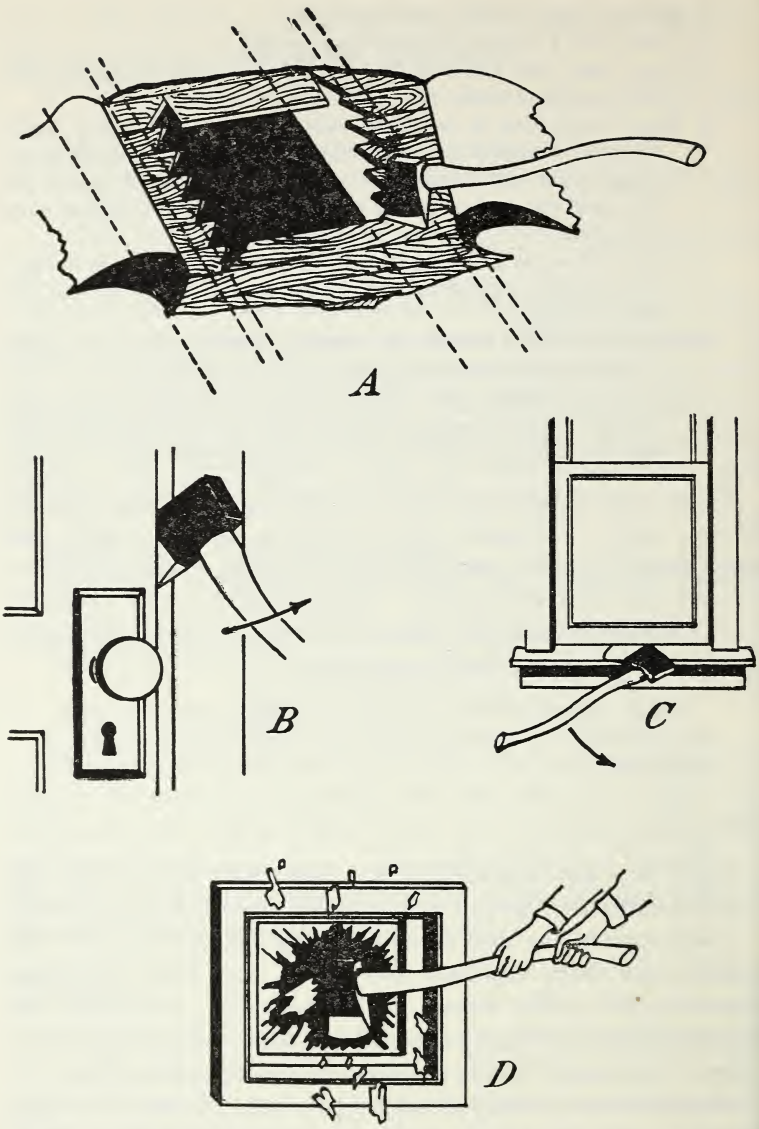

Figure 23.—A, Cutting open a roof or floor; B, prying open a door; C, prying open a window; D, smashing a window.

smothering it with this soil. Wet sacks, green pine tops, and fire swatters also are effective.

Standard power pumps and hand pumps can be used in fighting grass fires. The blaze is checked with water, then the fire is extinguished by swatting or by smothering with soil.

The backfires sometimes used in fighting grass fires are dangerous because a change of wind may spread the fire and make it burn more rapidly.

Backfire should never be used unless it can be controlled.

Grass fires should be controlled and forced to burn themselves out before they reach large proportions. Fighting is done at the head or at the flanks, or sides, to bring about the quickest control. Combinations of methods and equipment—water, plows, shovels, swatters, and backfiring—can be used effectively. Always try to fight the fire at its burning front. If it is too hot to attack directly use the following general method:

1. Go far enough ahead of the fire and plow one or more furrows in a U-shape that will make a pocket to head off the fire.
2. Have a torchman burn a narrow strip 1 to 2 feet wide as a backfire strip.
3. Approximately 50 feet back of the first backfire, burn another swath about 10 feet wide.
4. If the fire is large, another series of 10-foot fire swaths may be burned at 50-foot intervals back of the last fire.
5. The flank of the fire may be controlled by the use of water or of swatters, shovels, plows, or other suitable tools.

Forest Fires

Fire in forests and woodlands calls for special methods of suppression. Know your local fire warden and notify him immediately of any forest fire.

Our woodlands are set on fire by matches, cigarettes, or camp fires, by the carelessness of hunters, trespassers, or brush burners, or in some instances by intentional burning. The indiscriminate burning of woodlands is to be discouraged, and of course fires should never be permitted in unprotected timber areas.

Sometimes lightning or sparks from engines cause fires.

Farm people who live in wooded areas should have a general understanding of the nature of forest fires and of the principles of suppression. Forest fires can be put out more quickly if their behavior under different conditions is known. Some of the factors are:

1. Velocity of the wind and its direction. These largely regulate the intensity of the fire and the direction it takes. The sudden shifting of winds adds to the difficulties of fire fighting.

2. Intensity of the fire. This is governed to a considerable extent by the quantity of moisture in the air. Low humidity causes fires to burn more rapidly. On clear days the humidity is low at midday and rises late in the afternoon or toward evening. The tendency of fires to spread is usually checked when the relative humidity is above 50 percent; they become more dangerous when the relative humidity is below 40 percent.

3. Character and quantity of material on the ground. This factor also is important in the intensity of the fire. A fire in an old cutting is more difficult to put out than one in leaves and growing trees.

4. Temperature. High temperature tends to increase the burning of a fire. This is generally due to the association of low humidity and the rapid drying of fuel.

5. Direction on slopes. Fire usually burns uphill faster than downhill but sparks and tumbling logs increase the tendency of a fire to spread when it burns down the slope.

6. Time of day. Usually fires burn most rapidly from 10 a. m. to 5 p. m. and gradually with less intensity at night and in early morning, when the temperature is low and the humidity high.

Although each fire is different from others, general methods of attack have become established as follows:

The direct method is an attack on the burning edge of the fire with water, rakes, swatters, shovels, and other tools to knock it down and strike it out. It is frequently the practice to dig trenches down to mineral soil to keep the fire from spreading through roots and organic materials.

The 2-foot method is ordinarily applied to slow-spreading fires burning in peat and other soils containing a large quantity of organic matter or having much vegetation on the surface. The trench is dug about 2 feet from the edge of the burning material and sufficiently deep to reach the mineral soil.

The parallel method consists in moving back 10 to 50 feet from the edge of the fire and there raking and burning out a fire line.

In addition to the 2-foot and the parallel methods, other indirect methods consist of backfiring from a natural firebreak, such as a road or stream, or from a construction line 50 feet or more from the fire.

General rules for forest fire fighting include:

1. Have a leader in full charge of directing the work.
2. Keep cool and plan a systematic attack.
3. Determine the direction of the wind and fight the fire at its head if there are enough men and equipment.
4. Consider the time of day and exercise precautions against rapid burning from 10 a. m. to 5 p. m. Usually slower burning may be expected at night and early in the morning.
5. Scout the entire fire and work at the most effective points.
6. Select tools and equipment carefully and do not burden men with unnecessary loads.
7. Be on the lookout for spot fires started by flying embers—put out the little fires immediately.
8. Use backfire with care and only when necessary.
9. Don't leave a fire until it is dead out.

Hazards and Precautions

Fire fighting has many hazards, so farmers should learn to protect themselves and others from being injured. Thorough training and skill will reduce these hazards, but firemen should be careful at all times.

Partly burned buildings may fall and bring down burned timbers and bricks on firemen.

Floors and walls may cave in.

Broken glass and other sharp objects may injure firemen and damage equipment.

Electric lines and equipment are hazardous until the current is shut off.

Sparks and embers may spread fire to other buildings and burn the skin and clothing of firemen.

Livestock may stampede. Frightened animals may run back into a burning building or scatter sparks and fire in seeking shelter.

The following materials and equipment are hazards in farm fires: Cotton, clothing, sacks, paper, hay, straw, and lumber; gasoline, kerosene, oils, grease, gas, paints, cleaning fluids, insecticides, dynamite, blasting caps, nitrates, potash, and lime; stoves, furnaces, fireplaces, and gasoline and kerosene lamps and lanterns; electrical equipment—engines, motors, and power machines.

Rescue Practice

Every fireman needs training in rescue practice. He should know how to rescue—

1. Families from burning buildings.
2. Firemen trapped while at work.
3. Persons in contact with electricity, including power lines and lightning.
4. Persons in water accidents—drowning.
5. Persons stranded by storms and floods.
6. Persons endangered by frightened animals.
7. Persons injured and caught in mechanical equipment.
8. Livestock.

Rescue work requires special training to recognize various hazards and to apply the best rescue practice for different kinds of accidents. Rescue is closely related to first-aid work. In each neighborhood fire company, several persons should be thoroughly trained in first aid. Trained nurses and farm women who have had special training in first aid will be particularly helpful.

Rescue work involves the use of ladders, ropes, tools, and blankets in removing people from danger, in resuscitation

practice, and in first-aid treatment, and the use of improvised stretchers in carrying and transporting injured persons.

Training in first aid, lifesaving, and in farm safety practices can be obtained from the American Red Cross. In some instances emergency training will prevent accidents and losses, as in pumping fresh air into wells and in pumping out flooded basements.

GENERAL RULES FOR FIRE FIGHTING

1. Do not waste water and chemicals by throwing them blindly into a smoky room.
2. Locate the fire and apply water or chemicals on the burning materials—not on the flames above the fire.
3. Work ahead of the fire—head it off to prevent its spread.
4. Hit the fire with water or chemicals—wait a moment—and hit again.
5. Do not cause unnecessary damage to structures and furniture by using more water than necessary.
6. Do not enter a smoky, burning building until firemen and fire-fighting equipment are ready to begin work.
7. Douse the ceiling or wall of a room in such a way that the water will be deflected to hit a fire that cannot be reached directly.
8. Do not break open doors and windows—pry them open without damage.
9. Never leave a fire until it is dead out—every ember.
10. Have the salvage crew guard all property until there is no possibility of fire recurring.

FIRE-PREVENTION CHECK

Many farm fires could be prevented by thoroughly checking the buildings and equipment for fire hazards at least once a year. The following list of hazards includes many of those frequently found on farms and may be expanded to include all types found on any farm. It may be used as a guide in checking the farm and the home:

	Yes	No
1. Fireplaces, flues, and chimneys are sound and in good repair	.....	.....
2. Stoves, furnaces, and other kinds of heating equipment are in good condition and operated safely	.....	.....
3. Gasoline and kerosene are stored safely in underground tanks or in metal containers in buildings located away from house and barn	.....	.....
4. Lightning rods and metal roofs are in good condition and grounded to moist earth	.....	.....
5. Matches are kept in metal containers and placed so they cannot be reached by small children	.....	.....
6. Attics, basements, closets, and stairways are kept free from accumulations of old clothes, books, papers, rags, and other hoarded material that might be a fire hazard	.....	.....
7. Buildings are kept in good repair, particularly the roofs and other parts, to prevent leaks	.....	.....
8. Electric wiring, motors, and appliances are clean, sound, and in safe operating condition	.....	.....
9. Tractors, trucks, engines, and automobiles are properly equipped with good mufflers and exhaust pipes and never stored or operated in the barn or in other buildings where they might cause a fire	.....	.....
10. Smoking is not permitted in the barn or in other places where a fire might be started by accident or carelessness	.....	.....
11. Old clothes, sacks, oily rags, and similar materials have not accumulated on piles where they might start a fire by spontaneous ignition	.....	.....
12. Hay is properly cured before it is stored, to prevent heating and causing a fire by spontaneous ignition	.....	.....
13. Dry grass, trash, brush, and weeds are not permitted near buildings and fences around the farmstead	.....	.....
14. In dry areas and in dry periods fields of grass and ripening grain are protected by firebreaks	.....	.....
15. Woodlands and forests are protected by fire lines	.....	.....
16. Hunting, fishing, camping, and trespassing are regulated to prevent fires	.....	.....

17. Farm workmen and children are taught how to use equipment and supplies that might cause fires..... ....
18. Water supplies are available, and suitable forms of fire-fighting equipment are provided and kept in good working order ....
19. Plans have been made to fight fire, and every member of the family and all workmen know what to do if a fire occurs..... ....

In addition, buildings, livestock, and personal property should be adequately covered by fire insurance.

SOURCES OF INFORMATION

It is not practicable to list all the agencies, associations, and companies and the published materials relating to fire prevention and fighting and farm fire control. Following is a partial list of sources from which information and assistance can be obtained:

American Red Cross—Offices in all States.
American Society of Agricultural Engineers, St. Joseph, Mich.
County agents' offices.
Fire insurance companies.
Forest fire wardens.
Local fire chiefs.
Manufacturers of fire extinguishers and accessories.
Manufacturers of pumping equipment.
National Board of Fire Underwriters, 222 West Adams St., Chicago 6, Ill.
National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.
National Fire Waste Council, Chamber of Commerce of the United States, Washington 6, D. C.
National Safety Council, 20 North Wacker Drive, Chicago 6, Ill.
National Youth Farm Safety Program, National Association of Mutual Insurance Companies, 2105 Meridian St., Indianapolis 7, Ind.
State colleges of agriculture.
State departments of forestry and conservation.
State fire marshals.
United States Department of Agriculture, Washington 25, D. C.
United States Department of the Interior, National Park Service, Washington 25, D. C.

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